Materials Engineering Branch

TIP*

No. 094 Stress Corrosion Cracking in Stainless Steels

Author(s): Robert E. Shelley Contact: (301) 286-6882

Stainless steels are commonly used in the fabrication of space flight hardware. They are grouped according to the final metallurgical structure obtained, e.g., ferritic, austenitic, precipitation hardened and martensitic types. The different types offer the designer a variety of material properties such as: resistance to general corrosion as well as to stress corrosion cracking (SCC), strength, toughness, formability, machinability, and weldability.

Although all of the above properties are important in making the material selection, the designer is cautioned against the use of any alloy that does not have high resistance to SCC. Alloys that are not highly resistant to SCC require submittal of a Material Usage Agreement (MUA) when used for structural applications for space flight hardware. The following general comments regarding SCC for stainless steels apply.

The austenitic type, i.e., 300 series and A-286 precipitation hardening (PH) stainless steel are generally highly resistant to SCC. The precipitation hardened stainless steel, (i.e., 17-7PH, PH15-7Mo, PH14-8Mo, AM 350, AM 355) and the martensitic type of the 400 series and PH stainless steel (i.e., 17-4PH, 15-5PH, AM 362, AM 363) vary in susceptibility to SCC from extremely high to extremely low depending on composition, cold working and thermal treatment. Most of the PH stainless steels can be heat treated to make them less susceptible or even immune to SCC, but with some reduction in strength. To avoid stress corrosion cracking related problems with these and other alloys, the reader is referred to MSFC-STD-3029, titled, "Design Criteria for Controlling Stress Corrosion Cracking."

The ferritic stainless steels, such as types 405 and 430, should also be considered when the potential for stress corrosion cracking exists.